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AN EXPERIMENT IN A PRONUNCIATION PROBLEM.

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A GROUP OF 136 STUDENTS IN GERMAN ONE, TWO, AND THREE AT THE UNIVERSITY OF CALIFORNIA AT BERKELEY PARTICIPATED IN AN EXPERIMENT IN WHICH TESTS WERE MADE OF THEIR PRONUNCIATION OF INITIAL GERMAN "S" CLUSTERS (THOSE WHICH ARE SPELLED "S--" AND THOSE SPELLED "SCH--"). THIS PARTICULAR PRONUNCIATION PROBLEM WAS SELECTED BECAUSE THE GERMAN AND ENGLISH SOUNDS ARE UNIFORMLY OPPOSITE. THE STUDENTS WERE GIVEN A LIST OF 60 GERMAN WORDS TO RECORD ON TAPE, AND IT WAS EXPECTED THAT FOUR POSSIBLE TYPES OF PRONUNCIATION ERRORS WOULD RESULT. HOWEVER, NONE OF THESE ERRORS TOOK PLACE. THE TAPES SHOWED THAT STUDENTS OF ALL THREE SEMESTERS MADE ROUGHLY THE SAME ERRORS, AND THAT NO SIGNIFICANT AMOUNT OF LEARNING TAKES PLACE BETWEEN GERMAN ONE, TWO, AND THREE. THE CONCLUSIONS INDICATED THAT THE LEARNING OF PHONETICS SHOULD TAKE PLACE DURING THE FIRST CONTACT HOURS IN GERMAN ONE, AND THAT IT IS POSSIBLE THAT A COMPLETELY NEW FOREIGN SOUND IS MORE EASILY LEARNED THAN A FAMILIAR ONE IN A NEW CONFIGURATION. THIS ARTICLE APPEARED IN THE "INTERNATIONAL REV. OF APPLIED LINGUISTICS IN LANGUAGE TEACHING," VOLUME 4, NUMBER 4, DECEMBER 1966, PAGES 255-259. (AS)

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AN EXPERIMENT IN A PRONUNCIATION PROBLEM

Lyn Roland

L'expérience décrite ici avait pour but d'analyser la façon dont des élèves de collège américains maîtrisaient la prononciation du son [š] au début des mots pendant les trois premiers semestres d'allemand. On a choisi d'examiner ce problème parce que la prononciation [š] du *s*-initial suivi d'une occlusive en allemand contraste avec la prononciation [s] en anglais.

136 élèves des trois semestres ont enregistré une liste de 60 mots allemands. On avait pensé que les erreurs se distribueraient selon un de quatre schémas possibles. En l'occurrence les résultats n'ont correspondu à aucun de ces schémas.

Les étudiants de tous les trois semestres faisaient à peu près le même nombre d'erreurs: aucune amélioration n'était sensible d'un semestre à l'autre. Devant ces résultats, on peut se demander si ce n'est pas pendant les toutes premières heures de l'enseignement qu'a lieu l'apprentissage phonétique. Il est d'ailleurs possible qu'on apprenne un son étranger complètement neuf plus facilement qu'un son connu dans un contexte nouveau.

Der vorliegende Versuch diente dazu, amerikanische Deutschstudenten (1.–3. Semester) bei der Aussprache von [š–] Gruppen im Wortanfang auf Band aufzuzeichnen und auszuwerten. Die Untersuchung bezog sich auf dieses bestimmte Ausspracheproblem, weil im Deutschen Anfangs *s* plus Verschlußlaut phonetisch [š] ist und in völligem Gegensatz zum Englischen *s* plus Verschlußlaut steht, welches phonetisch [s]ist.

136 Studenten aus Deutsch I–III bekamen eine Liste mit 60 deutschen Wörtern und nahmen ihre Aussprache dieser Wörter auf Band auf. Auf Grund von Erfahrungen im Klassenunterricht und anderen Überlegungen erwartet man, daß eine von vier möglichen Fehlerarten auftreten würden. Keines der für möglich gehaltenen Resultate stellte sich jedoch ein. Beim Auswerten der Bänder zeigte es sich, daß die Studenten aller drei Semester ungefähr gleich viele Fehler machten und daß zwischen Deutsch I, II und III kein ersichtlicher Fortschritt im Lernen nachzuweisen war. Angesichts solcher Ergebnisse kann man sich fragen, ob das Erlernen der Phonetik nicht vor allem während der ersten Unterrichtsstunden stattfindet. Außerdem ist es möglich, daß ein völlig neuer Fremdlaut besser gelernt wird als ein bekannter Laut in einem neuen Zusammenhang.

I. *The Experiment:*[1]) In order to test and compare the correctness of pronunciation of initial German [š--] clusters by American students in their first, second, and third semesters of German at the University of California, Berkeley, the

[1]) This experiment was performed during the Fall semester, 1965, at the University of California at Berkeley, under the supervision of Jesse O. Sawyer, directer of the language laboratory. Alfred Jarret, professor of mathematical psychology, made a number of suggestions which are incorporated in this paper. Mr. Stelios Perrakis, a colleague in Industrial Engineering, performed the statistical analysis. I am also grateful to Dr. Earl Stevick of the Foreign Service Institute, Washington D. C., for his invaluable help in editing and organizing this manuscript.

students recorded a list of words which they were asked to pronounce as well as they could. The number of right and wrong answers was then tabulated for each student and for each cluster, to determine how much learning—if any—takes place between the first, second, and third semesters, and to see whether some cluster combinations are more difficult than others. Two types of [š–] cluster were tested, those which are spelled *s*– and those which are spelled *sch*–.

II. *The Theory:* This particular pronunciation problem was selected for study because word-initial German orthographic *s* plus stopped consonant is phonetically [š] and is in perfect contrast with English *s* plus stopped consonant, which is [s]. Orthographic *sch*– in German represents [š] before a liquid or nasal. (In both languages the clusters in question normally occur at the beginning of morphemes. In both languages, there is a limited number of foreign words which do not conform to the pattern, but they do not occur in the textbook used and were considered insignificant for the purposes of the experiment.) Thus, where a word is spelled *sp*–, a German speaker will automatically pronounce [šp–] but an English speaker will say [sp–].

From a linguistic point of view, there should be little problem for the student in mastering this pattern, since the German pronunciation uniformly contrasts with the English, and the sound with which the English speaker must respond to the German cluster is one which exists in his own language. But experience suggests that the problem is not so simple.

In considering the relative difficulty of clusters with $s + C_{stop}$, we would expect on the basis of classroom experience and other considerations one of four patterns: (1) all clusters tested (*sp*–, *spr*–, *st*–, and *str*–) are of equal difficulty; (2) the difficulty of a cluster is dependent on its density, so that *sp*– and *st*– produce similar difficulties, as do *spr*– and *str*–; (3) there is something inherently difficult for the English speaker about [t^h] in combination with [š] so that *st*– and *str*– pattern together in frequency of mistakes; (4) the difficulty of the cluster is determined by the following vowel. None of these results was obtained when the tabulated data were statistically analyzed.

Classroom experience had suggested that there where written German showed $sch + C\begin{Bmatrix}\text{nasal}\\\text{liquid}\end{Bmatrix}$ for [š], students regularly pronounced the cluster correctly. These clusters, when tested, were in fact rendered correctly in essentially 100 % of the responses.

A further question we would want to ask is, at what point is the contrast mastered? Will the student grasp this pattern at some moment between German I and III? Will he learn it slowly, cluster by cluster? Or will he fail to learn it at all?

III. *The Method:* 93 students from German I (first semester), 25 from German II (second semester) and 18 from German III (third semester) were selected at random and given a list of 60 words to record. 29 of these words were decoys; and, for the German-I students, all were words which they had not seen

before in the course of their classwork. From the word list as the student saw it, it was impossible to guess that only one specific pronunciation problem was being tested. No time limit was set and a student was free to repeat a word if he felt he had made a mistake. The student was told only that, in an attempt to improve teaching methods in the German Department, we were trying to find out to what extent pronunciation should be stressed, and that his performance would not be graded or counted as part of regular classwork. The resulting tapes were listened to repeatedly both by the experimenter and by two helpers. The latter did not know German and were instructed to listen only for the correctness of the cluster in question. Each pronounciation was scored on a basis of "right", "wrong", or "in-between". The last category contained so few events that later in the statistical analysis its members were distributed randomly between the first two.

A. *Analysis of Consonant Cluster Effects:* The data were analyzed as a two-way layout, with one observation per cell for each class, in order to test for the main effects of the consonant clusters *sp–*, *st–*, *spr–* and *str–*, and the vowels *a, e, i, o* and *u* (Umlauted vowels and diphthongs were not included). Therefore, the factors were at 4 and 5 levels each and interaction was assumed to be zero. A considerable portion of the data was screened out in order to have a complete two-way layout. To facilitate the computations, and because the effect was insignificant, an equal number of observations were considered for each cell, specifically, 93, 25, and 18 for German I, II and III respectively. This result was achieved by allocating the missing observations at random between correct and incorrect answers. To repeat, the number of these answers was insignificant. The binomial proportion of errors in the total number of observations was taken as the variable and the variance was stabilized by the arcsin transformation. The results were as follows in terms of F-ratios:

	German I	German II	German III
Vowel main effects $F_{4,12}$	1	1.238	1.078
Consonant main effects $F_{3,18}$	5.25*	6.791**	17.77***

* significant at 2.5 % level
** significant at 1.0 % level
*** significant at 0.5 % level or better

The t-tests on contrasts among the consonant main effects showed that main effects due to *str–* were significantly different from all the others at 10 %, 10 % and 1% levels respectively for German I, II, and III. In other words, the following vowel has no significant effect; but *str–*, when contrasted with the other clusters *st–*, *sp–*, and *spr–*, shows a significantly higher number of mispronunciations.

B. *Over-all Learning Tested:* The binomial proportion here was the proportion of words pronounced incorrectly by each student. The data were analyzed as a one-way layout with three possible levels corresponding to German I, II, III and with the number of observations in each level corresponding to the respective number of students, i.e., 93, 25, and 18.

Again, the arcsin transformation was used. The ANOVA table is shown below:

Source	SS	d.f.	MS
Between	1.93289	2	0.96644
Within	124.06137	133	0.93279

Average Transformed Error Proportions		[2])Corresponding Proportions
German I	1.5633	.495
German II	1.3672	.40
German III	1.24667	.34

$F_{2,133} = 1.03607$. This ratio is not significant at 10 % or less; therefore no significant difference exists between the proportions of errors committed by the students in the three classes. In other words, students in all three classes make approximately the same proportion of errors, and no significant amount of learning takes place between German I, II, and III.

IV. *Conclusions:* This experiment suggests that there can be considerable difficulty in learning a new phonetic patterning in a second language, even when the same sound exists in the native language. It demonstrates that, at least for this particular pattern, no significant learning occurs over three semesters of relatively intensive language study of the type pursued here. At least one-third of the students never realized there was a pattern at all.

Where German spelling *sch–* suggested [š–], the students pronounced the clusters correctly. This fact is strong evidence for the importance of the written symbol.

Surprisingly, of the four clusters of the type [š + C_{stop}], *str–* proved to be significantly more difficult than the others.

V. *Applications:* The main interest of the experiment is the questions to which it gives rise. If learning does not occur between German I and III, when does it occur? Early in German I? During the first few class hours? The linear trend of the transformed error proportions for learning may also be interpreted as evidence that the students tested might be divided into two groups, a group of non-learners and a small group (so small as to be insignificant in our figures) of learners. How are these groups, if they exist, to be sorted out?

How far can spelling be used as a teaching device? Would the exclusive use of an audio-lingual method without written tests during, say, the first week of

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[2]) The differences, though non-significant, show a linear trend, which could be the result of dropouts of poor students from German I and II.

instruction, followed by the use of a phonetic representation, engrain the new patterns?

How can phonetic patterns be taught?

What is the cause of the significantly greater difficulty students have with *str–* clusters? It seems to be an articulatory problem. Students who used the English [r] almost always had the cluster wrong. English [s–] is formed very near the teeth, and the English [r] is also articulated frontally. In contrast, German [š–] is produced against the hard palate. Where students used a back or uvular [R] the cluster was usually rendered correctly.

Finally, it would also be interesting to study a pronunciation problem containing a sound which does not occur in English, such as the rounded front vowels, and compare the proportions of incorrect answers and the degree of learning with our present figures. I suggest that a sound which is markedly foreign to English will be learned, in part at least, more quickly than a familiar sound which patterns differently.

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